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**DFCM**

# **CADD CRITERIA**

The DFCM Supplement to the United States National CAD Standard



Published by the DFCM Computer Aided Design Services Program  
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## AMENDMENTS

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# PURPOSE

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This Criteria is part of an initiative to address the entire life cycle of facilities within the DFCM. Due to the long life cycle that may be expected of State facilities and future requirements for maintenance and remodeling, standards are crucial. Utah State has long needed a comprehensive standard for organizing drawings to ensure consistent electronic deliverables (products); therefore, after extensive research the DFCM has accepted the most current version of the United States National CAD Standard (NCS).

The purpose of the DFCM CADD Criteria is to become an appendix (or supplement) to the United States National CAD Standard and will address **DFCM specific requirements** that are not covered in the United States National CAD Standard.

**\*Note:** The CAD Criteria and the NCS should be read together as a whole and are not complete one without the other for all DFCM projects. The NCS can be obtained from:

[www.nationalcadstandard.org](http://www.nationalcadstandard.org)  
[www.csinet.org](http://www.csinet.org)  
[www.aiaonline](http://www.aiaonline)

## UNITED STATES NATIONAL CAD STANDARD

In 1995, the combined resources of the Tri-Service CADD/GIS Technology Center, the American Institute of Architects (AIA), the Construction Specifications Institute (CSI), the United States Coast Guard, the sheet metal and Air Conditioning Contractors National Association (SMACNA), the General Services Administration (GSA), and the National Institute of Building Sciences' (NIBS) Facility Information Council agreed to develop an integrated set of documents that collectively would represent the United States National CAD Standard. After its own extensive research, the DFCM, has accepted the most current version of the United States National CAD Standard (NCS).

The sections of the United States National CAD Standard were developed as follows:

Layering and model file naming were developed and published by AIA, with assistance from CSI and TSTC. Drawing set organization and sheet file naming were developed and published by CSI, assisted by TSTC, and reviewed by AIA.

Sheet organization was developed and published by CSI, with assistance by AIA and TSTC.

Schedules were developed and published by CSI, with assisted by TSTC, and reviewed by AIA.

Plotting Guidelines (colors and line weights) were developed by TSTC and the United State Coast guard, published by TSTC, and reviewed by CSI and AIA.

Drafting Conventions including notations, symbols, diagrams, scales, and line types were developed by CSI, TSTC, the United State Coast Guard, and SMACNA; assisted by AIA; and published by CSI.

Non-graphic attributes will be developed and published by TSTC, the international alliance for Interoperability (IAI), vendors, and trade associations, with review by CSI and AIA.

Each of these documents can currently be obtained from the authoring agency or can be purchased together as the United States National CAD Standard. Additional information on the United States National CAD Standard can be obtained from:

[www.nationalcadstandard.org](http://www.nationalcadstandard.org)  
[www.csinet.org](http://www.csinet.org)  
[www.aiaonline](http://www.aiaonline)

## BACKGROUND

The immediate benefits of CADD standards are many: consistent CADD products for customers; uniform requirements for A/E deliverables; sharing of products and expertise; and collection, manipulation, and exchange of database information.

All A/E agreements dated on or after September 7, 2000 are required to comply with the current standard. DFCM recognizes that there are individual office standards that may need to change but are not responsible for time or budget restraints.

# GENERAL CONDITIONS

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The listed rules, standards, codes, DFCM Design Criteria, DFCM CADD Criteria and its references shall be read together as a whole in order that all provisions may be operative. In case of conflict between any of the provisions of the rules, standards, codes and criteria documentation, the most stringent requirement shall govern. When none of the listed rules, standards, codes or criteria address an issue, contact the DFCM.

## DRAWING TYPES

The Architect and Engineer shall work with DFCM's Project Director in determining the project needs. The current National CAD Standard will provide formatting guidelines for all projects and the DFCM Computer Aided Design Program will review all electronic files for standards compliance.

Isometric and Perspective Views: Renderings in isometrics, perspective photographs, reproductions or pictorials may be used on drawings when necessary to clarify a design.

Models and Renderings: The use of models and renderings may be used to supplement and explain the design.

Contract Documents: These documents shall convey to all concerned (contractor, manufacturer, fabricator, etc.) the information necessary for the required work. It is essential that the documents be accurate and explicit. The elements of the contract documents shall be properly coordinated to minimize conflicts between drawings, notes, specifications and:

- a. Be sufficient for completion of the project and include site information, the extent, size, shape and generic types of materials, and the relationship between materials. Some duplication of items included in specifications may be desirable in the structural general notes for emphasis. If duplication does occur, the Architect and Engineer must carefully review the contract documents, notes & specifications for consistency.
- b. Show permanent survey control points (benchmarks).
- c. Complete finish, door, window, hardware and fixture schedules, or any other schedule that may apply to the project.
- d. Contain complete dimensioning to construct the facility. The DFCM Program Manager, Project Coordinator or Engineer reserves the right to

withhold approval if dimensions are insufficient to construct the facility.

- e. Show the relationship of existing utilities, easements, property interests and encumbrances that the Architect and Engineer have knowledge of or should have knowledge of by reasonable investigation, to those utilities, easements, property interests and encumbrances designated as new.

Shop Drawings: Shop drawings are defined in the DFCM Design Criteria's General Conditions.

As Built Drawings: Record Drawings are defined in the DFCM Design Criteria's General Conditions. Their accuracy is of paramount importance. Special attention should be given to accurately recording on-site utilities.

## STANDARDS COMPLIANCE

Drafting requirements discussed in these criteria shall be incorporated in the drawing presentation. The A/E shall submit CADD examples by email or on electronic media as described in this document (see deliverables/data exchange). CADD examples shall be submitted to the DFCM CAD Services Program prior to preparation of any initial Contract Documents for a review on standards compliance. All changes must be made prior to the next phase of plan checking and must be resubmitted.

The examples and the final CADD drawings shall be **100% compatible** with DFCM's system as described in this document. Specifications and O&M Manuals shall also be turned in electronically (see deliverables/data exchange).

The A/E must coordinate the CADD documents to standardize the graphic depictions as to scale, style, orientation and format with all of the current United States National CAD Standard design disciplines in mind, and all the DFCM requirements as described in this document.

**\*Note:** Any change that affects the "as-built drawings" must be recorded and accompanied by a new drawing, preferably done using computer aided design drafting (CADD). As an exception, for a contractor when an architect is not involved in a project, at a minimum must provide a redlined drawing or sketch accompanied by digital photograph, showing all project specifications, to the DFCM CAD Services Program for as-built drawings to be updated.

# DELIVERY AND DATA EXCHANGE

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The need to exchange digital data (drawing files and database information) between DFCM elements and the A/E community necessitates answering many questions about electronic media, file format, etc. The overview presented should not be considered a standard or all-inclusive. It is presented only as a checklist of pertinent items.

## DELIVERY MEDIA

The preferred type of media for data exchange depends on both the hardware/software platforms utilized in creating a drawing/data file and the size of the file. Generally, digital data sets larger than 9 megabytes (Mb) should be provided on CD-ROM and not on multiple diskettes.

***\*Note:** For archiving data, **CD-ROM is the preferred format for DFCM projects due to its extended shelf life.***

Other common and generally accepted formats for small projects are:

- a) 3 ½ " high-density floppy disks
- b) High Density disk (i.e. Zip disk, JAZ disk).

When digital media are exchanged, an external label should contain, at a minimum, the following information clearly labeled:

- a) Project Name
- b) DFCM Project Number
- c) Name of architect and/or engineer
- d) Drawing Phase (desdev, condoc, as-built)
- e) Sequence number (for multiple diskettes etc.)
- f) Date issued

In addition, a transmittal sheet should accompany the media containing, at a minimum, the following information:

- a) Format and version (i.e. Windows NT 4.0) of the operating system on which the media was created.
- b) Utility used for writing the files to disk
- c) A short description of contents

- d) Information included on the external label of each tape, diskette etc., total number of disks/tapes being delivered, and a list of the files names and file descriptions on each disk/tape.
- e) Instructions for restoring or transferring the files from the media.
- f) Certification that all delivery media is free of known computer viruses including the names(s) of the virus scanning software used and the date the virus scan was performed.

## FORMAT

All digital files should be delivered in a format that is directly readable and compatible with the installation's CADD software and platforms without conversion. Before a file is placed on the delivery digital media, the following procedures should be performed: Remove all extraneous graphics outside the border area, and set the active parameters to a standard setting or those in the seed/prototype file.

- a) All files, including all reference files (external reference) and all files done by consultants are attached without device or directory specifications.
- b) Compress and reduce all files using the appropriate utilities. A digital media copy of the decompression utility should be provided with the deliverable media, if appropriate.
- c) Include all files, both graphic and non-graphic, required for the project (i.e. color table, pen table, font libraries, cell/block libraries, user command files, plot files etc.)
- d) Make sure that all support files such as those listed in *d* are in the same directory and that references to those files do not include device or directory specifications.
- e) Include any standard sheets (i.e. abbreviation sheets, standard symbol sheets, etc.) necessary for a complete project.
- f) Document any nonstandard fonts or tables, symbols, etc. developed by the A/E or not provided with the Government furnished material.

## **DOCUMENTATION**

Complete documentation (i.e. data input procedures), pen settings, lock settings, reference files, cells, level assignments, and history (i.e. when developed/modified) information for each file should be included on level/layer \*-ANNO-NPLT (\*\* represents the design discipline). Documentation of the plot for each drawing is needed to access the plot at a later date and should be provided with the deliverables.

## **HARD COPY**

In addition to the electronic CADD files and related electronic documents, the A/E shall provide one full drawing set to the building owner and one full drawing set to the DFCM. The hard copy should be printed on non-glossy polyester film 3-mil thickness minimum. Standards Sheet sizes may be Architectural sizes 24" x 36" or 30" x 42".

# DRAWING FILE ORGANIZATION

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Organizing a set of drawings is influenced by many factors, including project size, complexity, regulatory and client requirements, and the type and number of contracts. The current United States National CAD Standard along with the supplemental DFCM CADD Criteria will provide guidelines for organizing drawing sets to accommodate these influences. Organization standards affect production, delivery, and identification of hard copy drawings as well as electronic CAD drawings.

The basic structure for organizing drawing sets is based on the traditional architectural/engineering disciplines. Drawings consist of plans, elevations, sections, large scaled views, details, schedules, diagrams, and 3D representations. The following standards shall apply for all DFCM projects.

Please contact the DFCM CAD Services Program for any modifications to the following guidelines.

## FILE ACCURACY

Microstation users should set the working units as the following:

- Master units (MU) = The largest unit that may be referred to when working in the design file (e.g. feet, meters).
- Subunits (SU) = Subdivision of master units in the working unit definition (e.g., inches, millimeters).
- Positional units (PU) = The smallest unit that may be addressed in the design file. The number of positional units per subunit determines the precision of the drawing and the size of the design cube.

Recommendations for working units in MicroStation design files are 1:12:8000 to allow accuracy to 0.001 of 1/8 in. (i.e. 1000 positional units per 1/8 in.).

AutoCad users should choose either the architectural (feet and inches), engineering (feet and tenths), or decimal (suitable for meters or millimeters) report formats as provided in the “units” command screen.

## ORIGIN (GLOBAL ORIGIN)

The origin of a drawing file is important because it serves as the point of reference from which all other elements are located. Origins are typically defined (located) in a drawing file by the Cartesian coordinate system of x, y, and z or for AutoCad users 0,0,0.

A standard origin is most beneficial in the use of reference files and in translating between CADD applications.

## MODEL FILES & SHEET FILES

Two distinct types of CADD files are addressed in this standard: model files and sheet files.

A **model file** contains the physical components of a building such as walls, doors, columns, ductwork, piping etc. Model files are drawn at full scale and typically represent plans, elevations, sections etc. They must comply with the NCS in regard to layer/level usage and symbology (If needed, additional information on level/layer usage between MicroStation and AutoCad users can be found in the A/E/C Standard published by the Tri-Service CADD/GIS Technology Center [www.tsc.wes.army.mil](http://www.tsc.wes.army.mil) ) Model files can also contain dimensions and annotation or other non-component information as long as they are not sheet specific information.

A **sheet file** is the “finished product”, synonymous with a plotted CADD drawing file. A sheet file is a selected view of the model file(s) within a border sheet with the origin of each sheet located at the lower left-hand corner of the sheet border. Sheet files are plotted at full scale (1=1), since the model files are referenced into the sheet file at a particular scale ratio. A sheet file is the combination of referenced model files with sheet-specific text/symbols to create a final “ready-to-plot” CADD file. See Figure 2 for example on sheet file composition.

**\*Note:** The DFCM prefers the border/title block and model files to always be referenced into a sheet file.

**\*Note:** A “ready- to-plot” sheet file should include the full size plot to be plotted at 1=1 and a reduced set “ready-to-plot”.



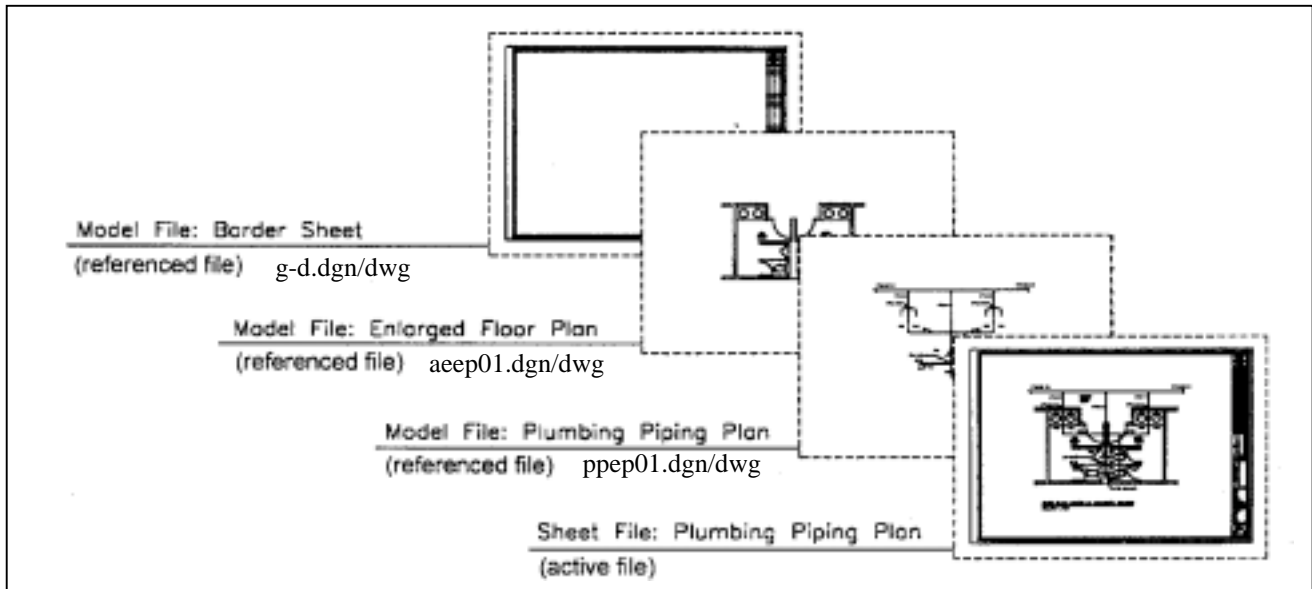


Figure 1: Sheet File composition

## ELECTRONIC FILE NAMING

Consistent file naming and folder (directory) structures are necessary for management of the information that is reusable from project to project, as well as effective management of the graphical and non-graphical information related to a construction project

In naming the electronic sheet files the format should be consistent with the sheet identification. The industry standard file naming conventions are those developed by the AIA model file naming and CSI's sheet file naming as part of the United States National CAD Standard.

For DFCM projects the 2-character discipline designator is preferred, especially for large projects. The simplified method using the 1 character discipline designator can be used for small projects. See Figure 3 for a sample and refer to the NCS for a complete list.

**Example 1:** The name for a simple architectural floor plan model file would be:

a-fp01.dgn/.dwg

## OPTIONAL FILE NAMING CONVENTION

An optional method of using a 5-digit project number as the first characters of the file name is acceptable. If needed, an additional version on conventional file naming can be found in the A/E/C Standard published by the Tri-Service CADD/GIS Technology Center [www.tsc.wes.army.mil](http://www.tsc.wes.army.mil)

**Example 1:**

Using the preferred 2 character discipline designator, the name for a simple architectural floor plan model file for project number 00451 would be:

00451aefp01.dgn/.dwg

**Table 1 - Industry Standard Discipline Designators  
One Character**

General	I
Hazardous Material	H
Survey Mapping	V
Geotechnical	B
Civil Works	W
Civil	C

Simplified Method (not a complete list)

**Table 2 - Industry Standard Discipline Designators  
Two Character**

General Information	GI
Structural Demolition	SD
Architectural Site	AS
Architectural Elements	AE
Interior Design	IN
Athletic Equipment	QA
Fire Detection and Alarm	FA
Mechanical Site	MS
Electrical Site	ES

\*\* DFCM Preferred Method (not a complete list)

**\*Note:** See NCS for a complete list

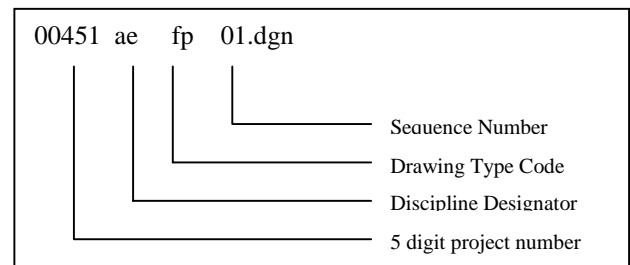


Figure 2: Optional model file naming convention

Table 3- Standard Industry Model/Drawing File Types		
Discipline	Code	Definition
All Disciplines		
	<b>FP</b>	Floor Plan
	<b>SP</b>	Site Plan
	<b>DP</b>	Demolition Plan
	<b>QP</b>	Equipment Plan
	<b>XP</b>	Existing Plan
	<b>EL</b>	Elevation
	<b>SC</b>	Section
	<b>DT</b>	Detail
	<b>SH</b>	Schedules
	<b>3D</b>	Isometric
	<b>DG</b>	Diagrams

Table 4- Standard Industry Sheet Types	
<b>0</b>	<b>General</b> (symbols legend, notes, etc.)
<b>1</b>	<b>Plans</b> (horizontal views)
<b>2</b>	<b>Elevations</b> (vertical views)
<b>3</b>	<b>Sections</b> (sectional views, wall sections)
<b>4</b>	<b>Large Scale Views</b> (plans, elevations, stair sections or sections that are not details)
<b>5</b>	<b>Details</b>
<b>6</b>	<b>Schedules and Diagrams</b>
<b>7</b>	<b>User Defined</b> (for types which do not fall in the other categories, includes typical detail sheets)
<b>8</b>	<b>User Defined</b> (for types which do not fall in the other categories)
<b>9</b>	<b>3D Representations</b> (Isometrics, perspectives, photographs)

The first level of each series is numbered 01, followed by 02 through 99. All sheets must stay consistent throughout each discipline. The recommended sheet identification format is applicable to both manual and CAD drawing production.

**\*Note:** Basements or lower levels can be shown as the following: a-fpb.

**\*Note:** Refer to the NCS for complete examples on how to organize sheets and files.

### Supplemental Drawings

Recommended:

R = Revised

X = Scope

A,B,C...= for phased work

**\*Note:** Some CD-ROM writing utilities do not recognize a hyphen (“-”) as a legal file name character. For these utilities, use either an underscore (“\_” for the hyphen).

## FILE STRUCTURE

The Industry Standard file naming methodologies rely on directory structure to differentiate individual projects. The possibility of overwriting files with identical names can be a recurring problem. Figure 3 shows a typical file structure for this method.

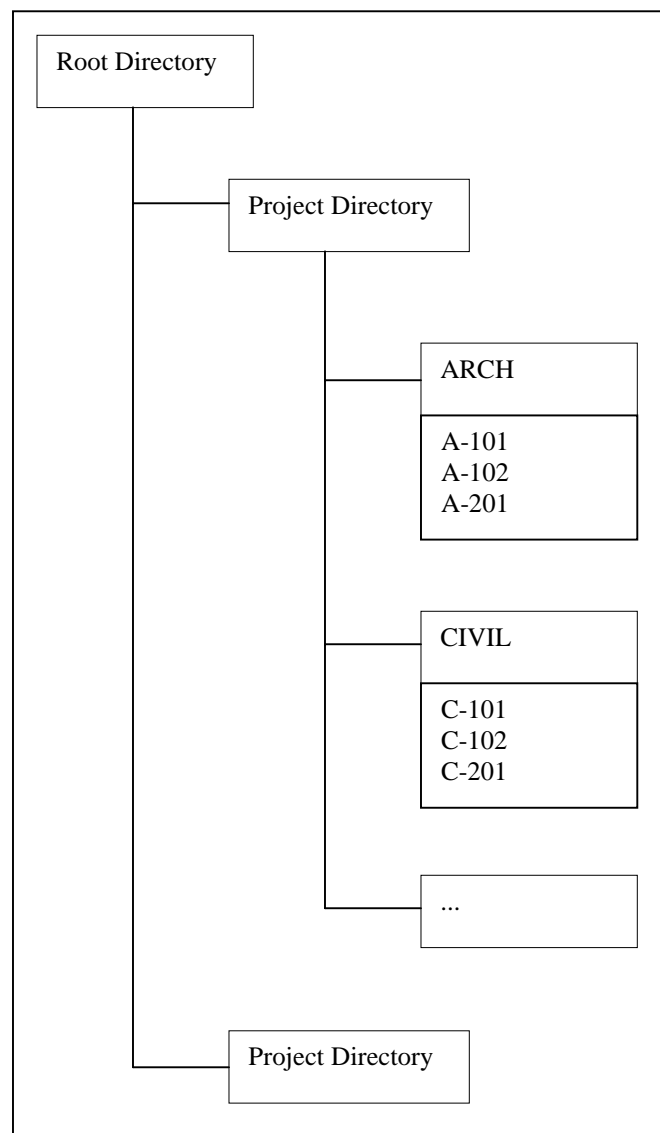


Figure 3: Preferred File Structure

# LEVEL/LAYER NAMING

The layer is the basic CADD tool for managing visual information. Layers allow for separation of graphic elements according to the design discipline they represent. Layers reduce drawing time and improve project coordination.

The American Institute of Architects has developed a recommended layering structure for AEC construction documents and related plan sets.

Adherence to this recognized and accepted AIA system is an integral part of the DFCM graphic standards and CADD file structure. This is accomplished by implementing a highly integrated combination of layer name tables and coordinated arrays of referenced CADD files. The following information is required for DFCM projects and should be used to supplement the current National CAD Standard.

## LAYER/LEVEL FORMAT

There are two formats the DFCM will accept: the Simplified Method and the Preferred Method.

Both methods consist of a two-character *Discipline Code*, followed by a four-character *Major Group*. The preferred method adds an additional four-character *Minor Group* to further differentiate items within the Major Group. An additional four-characters can be added as a *Status Field* when phase work needs to be differentiated.

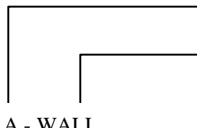
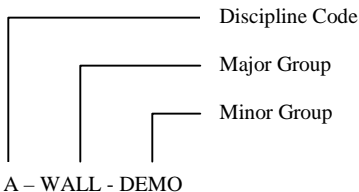
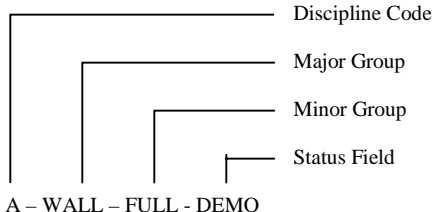
For very small projects where few levels/layers are required, the optional Simplified Method may be used.

**\*Note:** *The Preferred Method is recommended for DFCM projects because it can be used for large or small projects.*

Additional requirements are listed below:

- Layer/level and/or x-ref/reference file shall separate all components in a drawing.
- Users are free to add their own layers, but should identify them as “user-defined.” And must follow the standard alphanumeric format.
- Any deviation from the standard must be approved by the DFCM, clearly documented and submitted with the final set to DFCM.

**Table 5 - Level/layer naming format methods**

 <p>Discipline Code Major Group A - WALL</p>
<p><b>SIMPLIFIED</b></p>
 <p>Discipline Code Major Group Minor Group A - WALL - DEMO</p>
<p><b>*PREFERRED</b></p>
 <p>Discipline Code Major Group Minor Group Status Field A - WALL - FULL - DEMO</p>
<p><b>OPTIONAL</b></p>

## DATA ORGANIZATION

By using model files and sheet files plotting is made easier, especially for those unfamiliar with a project. It will be particularly helpful for DFCM because the architect's CAD drawings will need to be accessed for archiving purposes and future facility management needs.

Any CAD information that will be shared between multiple sheets, including annotation, should be contained in a model file.

# GRAPHIC ELEMENTS

## LINE WIDTHS

Line widths are explained in the United States National CAD Standard. The listed line widths in the NCS will be sufficient and should not be expanded unless an appreciable improvement in drawing clarity or contrast can be realized. Table 6 shows the standard line styles (courtesy of the Tri Service CAD/GIS Technology's A/E/C Standard).










Using the standard will ensure that drawings can be translated between systems with the assurance that line weights will be maintained even though the displayed color may vary.

**\*Note:** AutoCad polyline widths must be uniform throughout the extent of the line. Variable line width polylines do not translate between CADD packages.

## LINE COLOR

Line Color is primarily used in CADD drawings to improve the clarity of the drawing on a computer monitor. In AutoCad it is common to use color to identify layers and/or define thickness of lines. Based on the limitations of differing CADD system plotting methods, the DFCM recommends that all drawings be created using the basic colors presented in Table 7 whenever possible (courtesy of the Tri Service CAD/GIS Technology's A/E/C Standard). The line widths, colors and styles will coincide with the National CAD Standard's plotting guidelines.

**Table 6**  
**Standard Line Types/Styles**

ID	Description	Example	Microstation Designator	AutoCAD Designator	Dimensions
0	Continuous		0	Continuous	
1	Dotted		1	ACAD_ISO07W100	0,5, -3
2	Dashed		2	ACAD_ISO02W100	12, -3
3	Dashed spaced		3	ACAD_ISO03W100	12, -18
4	Dashed dotted		4	ACAD_ISO10W100	12, -3, 0,5, -3
6	Dashed double-dotted		6	ACAD_ISO12W100	12, -3, 0,5, -3, 0,5, -3
10	Dashed triplicate-dotted		-- <sup>2</sup>	ACAD_ISO14W100	12, -3, 0,5, -3, 0,5, -3, 0,5, -3
7	Chain		7	ACAD_ISO08W100	24, -3, 6 -3
11	Chain double-dashed		-- <sup>2</sup>	ACAD_ISO09W100	24, -3, 6, -3, 6, -3

<sup>1</sup>For line type dimensions, positive numbers signify length of dashes, negative numbers signify length of spaces.

<sup>2</sup>This line style is not found in the default MicroStation line style resource file.

**Table 7**  
**Screen Color Comparison and Associated Line**  
**Widths**

Color	Color Number		Line Width mm	Ratios of RGB, %		
	AutoCAD	MicroStation		Red	Green	Blue
Blue	5	1	.18	0	0	255
Gray	8	9	.18	128	128	128
Green	3	2	.25	0	255	0
Red	1	3	.25	255	0	0
Yellow	2	4	.35	255	255	0
Magenta	6	5	.35	255	0	255
Cyan	4	7	.50	0	255	255
White	7	0	.70	255	255	255

Note: Color numbers for AutoCad and Microstation were taken from default color tables.

## BORDER SHEETS

A common sheet size for all sheets in a set, including consultant sheets, is required due to filing hard copy documents, plotting capabilities, and to maintain a consistency for Facility Management users. DFCM will allow the use of the following NCS sheet sizes:

### Architectural

24" x 36"

30" x 42"

**\*Note:** Drawings smaller than 24"x 36" are not acceptable for construction/contract or "as-built" drawings. Reduced sets can be included in a project manual or specifications.

## COVER SHEET

The cover sheet shall identify the project, owner, and other project team members involved in the preparation of the drawings. A photograph, rendering, or logo of the owner/preparer is acceptable. If the cover sheet contains specific project data such as a table of contents, a listing of abbreviations etc. it should be identified with a sheet identifier containing the discipline designator GI for General Information, sheet type 0, and the sequence number 01 (G-001). DFCM plan review labels and state seal are required information. They can be downloaded off the DFCM web site at [www.dfc.state.ut.us](http://www.dfc.state.ut.us)

## TITLE BLOCK

For DFCM projects the title block area will be placed on each sheet in the NCS horizontal layout with the title block placed in the right hand margin of the border sheet as shown in Figure 4. The most prevalent information shall be placed at the bottom right of the sheet.

**\*Note:** In addition to the standard blocks in the NCS format, the DFCM requires the following:

### Project Identification Block to include:

- Descriptive project name & address
- Building or facility name
- State Property Number (acquired through DFCM)
- Construction phase sequence (if applicable)
- Project logo (optional)

### Issue Block to include:

- Phase issue dates
- Addendum issue dates
- Clarification dates
- Revision issue dates
- Description

All revisions on the Contract Documents shall be accomplished using the delta symbol placed adjacent to the revised element with the most current revision number. The portion revised shall be circled or ballooned on the drawing encompassing the delta symbol. Only the most current revision shall have the circle area depicted. **Previous revision delta symbols shall remain, but the balloon line shall be erased.** If an



entire drawing is revised or a new drawing is added to the set, place the revision mark in the issue block. Include in revision block, description column references to Change Order numbers with dates.

**Management Block** to include:

- DFCM project number
- Drawing preparer's project number
- CAD drawing file number
- Drawn by
- Checked by
- Designed by
- Drawing Type (Con Doc, As-built)
- Signature and date of Record Drawings
- Horizontal layout

## SHEET LAYOUT

In addition to the NCS, border sheets can be modified to include the following minimum margins:

### Optional Sheet Margins

Top & Bottom Margin: 20 mm (1/2 inch)  
Left Margin: 40 mm (1 1/2 inch)  
Right Margin: 20 mm (1/2 inch)

Contact the DFCM if plotting limitations occur.

## Drawing Area Coordinate System

A standard drawing module must be established. The preferred size is 5 3/4" x 6".

**\*Preferred:** 5 3/4" high x 6" wide (145 mm x 150 mm).  
On a 24" x 36" sheet with 1/2" margins this makes for a total of 5 rows and 6 columns for a total drawing area of 23" x 30".

## Production Data Area

Plotter Time and Date Block is optional. File path, sheet file name, default settings, pen assignments, printer plotter commands, reference files, layers, plotted, production hrs, etc. can also be part of the production block is applicable. If this option is chosen then it is preferred to be place on the outside lower left of the title block

**\*Note:** A sample Title block in MicroStation and AutoCAD formats are available for download at [www.dfcm.state.ut.us](http://www.dfcm.state.ut.us) . Please be aware that these are to be used as samples and may need to be customized to meet one's own standard operating procedures.

## TEXT/FONTS

Default MicroStation and default AutoCad fonts should be used whenever possible so there is minimal translation loss. True type fonts can be used as an option.

### Common .ttf Fonts for Notes:

Arial Narrow  
Arial

### Common .ttf Fonts for Title Blocks:

Times New Roman  
Roman

**\*Note:** If true-type fonts are chosen than the font library should be submitted with the electronic files.

**\*Optional:** Text within symbols can be 1/8" scale instead of 3/32" assuming that in the future the drawings may be reduced to half size or scanned.

## SCALE

Drawings are created at full scale and plotted at the selected scale. The scale chosen should be large enough to allow the drawing to display its graphic, dimensional, and textual content clearly. For DFCM projects, scale shall be expressed numerically and graphically on each sheet. See Figure 3.

- Scale can be expressed in metric, architectural, or engineering as appropriate to the project.
- Keep the same scale for drawings on a single sheet or else the scale must be shown for each drawing or view.
- Isometrics, diagrams, or perspectives do not need to be drawn to scale and should be labeled "Not to Scale."
- Plans, elevations, sections, and details must be drawn to scale and labeled as such.

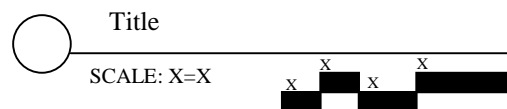


Figure 4: Numeric & Graphic Scale

## DRAWING ORIENTATION

All drawings or views should indicate the view presented.

- Ideally the floor plan should be shown on one sheet. If it cannot fit on one sheet, the floor plan should be subdivided into convenient segments with match lines provided to reference where the floor plan is continued.
- Civil plans may orient the drawing in a manner that will allow the site plan to fit within the sheet boundary at the appropriate scale. Orient the site plan in the same manner as the floor plans whenever possible.
- Every plan view shall have a north arrow orientation. Preferably, the plan north arrow shall point to the top of the drawing sheet. True north should be adjusted so the building grid and plan north arrow are parallel to the sheet orientation. The location of the north arrow and plan arrow should be placed in the lower right hand corner of the drawing block.
- Scanning Scale Block: Mandatory Graphical and numeric scale
- Display throughout the drawing set must stay consistent. For example, a column plan detail should be shown in the same orientation as it is shown on the floor plan.

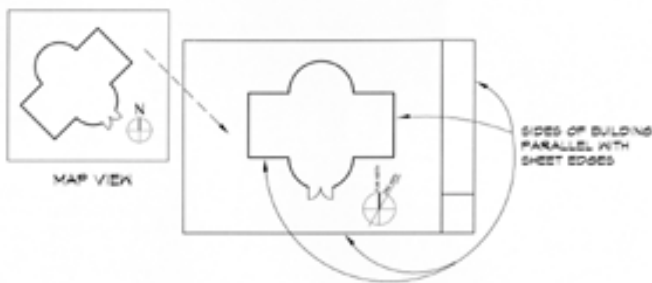


Figure 5: Drawing Orientation

## DIMENSIONING

Dimensions must be adequate and accurate. Each wall and part of a detail must be tied to a fixed point such as a column centerline or an existing or bearing wall. **This applies to the plans and the enlargements associated with them.** Exercise care in placement of dimension lines and (arrows/slashes) to convey clear intent. See the NCS for acceptable dimensioning techniques.

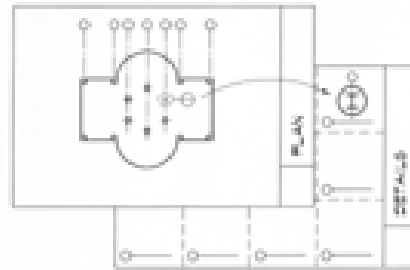


Figure 6: Grid Layout

# STANDARD IMPLEMENTATION TOOLS

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CADD users throughout the industry have indicated a need for customized shortcuts or utilities to facilitate efficient production of architectural and engineering CADD documents. At this time the DFCM has no such tool but will be providing it in the future. The United States National CAD Standard Implementation Task Team is also researching the development of implementation tools.

To meet the demand there are some implementation tools that have been developed by the CAD/GIS Technology Center for MicroStation and AutoCad users. The release of workspace 1.4 is compliant with the National CAD Standard.

For more information on these implementation tools go to the Tri Services CAD/GIS Technology Center web site at <http://www.tsc.wes.army.mil>

To become a member of the United States National CAD Standard go the official web site <http://www.nationalcadstandard.org> and sign up as an active member or a reviewer member.



## REFERENCES

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**AIA CAD Layer Standards Second Edition**, American Institute of Architects, 1999, American Institute of Architects Press, Washington, DC.

**Uniform Drawing System**, Module 1 and Module 2, Construction Specifications Institute, 1999, Alexandria, VA.

**National CAD Standard Version 2**, National Institute of Building Sciences, 2001 Washington, DC.

**A/E/C Standards**, Tri Service CADD/GIS Technology Center, 1999